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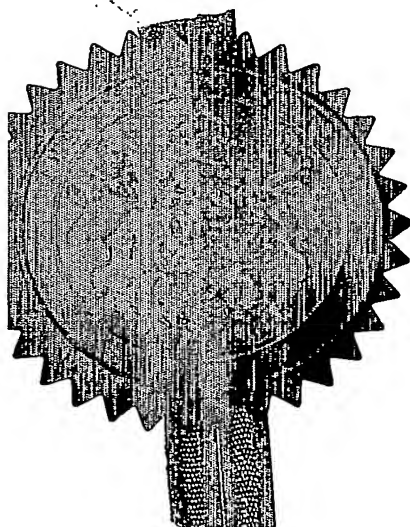
I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

I also certify that by virtue of an assignment registered under the Patents Act 1977, the application is now proceeding in the name as substituted.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

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Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed *le Behan*

Dated 27 March 2003



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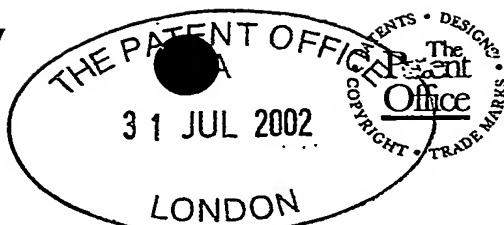
GB 0217767.3

By virtue of a direction given under Section 30 of the Patents Act 1977, the application is proceeding in the name of

XP PLC,  
16 Horseshoe Park,  
PANGBOURNE,  
Berkshire,  
RG8 7JW,  
United Kingdom

Incorporated in the United Kingdom,

[ADP No. 08520587001]



# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road  
Newport  
South Wales  
NP10 8QQ

1. Your reference DAK/HC/P9038GB

0217767.3

31 JUL 2002

3. Full name, address and postcode of the or of each applicant (underline all surnames)

XP ENERGY SYSTEMS LIMITED  
UNIT 14, HORSESHOE PARK,  
PANGBOURNE, BERKSHIRE  
RG8 7JW

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

ENGLAND AND WALES

SECTION 30 (1977 ACT) APPLICATION FILED 25/11/02  
8437311 001

4. Title of the invention

IMPROVEMENTS IN OR RELATING TO POWER SUPPLY

5. Name of your agent (if you have one)

DAVID KELLIE ASSOCIATES

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

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LONDON  
EC4M 7ET

Global  
change  
27/12/02  
furb

Patents ADP number (if you know it)

~~0461452006~~

0461452006

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

YES

- a) any applicant named in part 3 is not an inventor, or
  - b) there is an inventor who is not named as an applicant, or
  - c) any named applicant is a corporate body.
- See note (d))

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form.  
Do not count copies of the same document

Continuation sheets of this form

Description 15

Claim(s)

Abstract

Drawing(s)

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)

Request for preliminary examination and search (*Patents Form 9/77*)

Request for substantive examination (*Patents Form 10/77*)

Any other documents  
(please specify)

11. I/We request the grant of a patent on the basis of this application.

Signature  
David Keltie Associates  
DAVID KELTIE ASSOCIATES

Date  
31 JULY 2002

12. Name and daytime telephone number of person to contact in the United Kingdom  
HEATHER CROFT 020 7583 6000

**Warning**

*After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.*

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- b) Write your answers in capital letters using black ink or you may type them.
- c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- e) Once you have filled in the form you must remember to sign and date it.
- f) For details of the fee and ways to pay please contact the Patent Office.



## Uninterruptible Power Supply (UPS) On line model 700 to 6kVA UPS

### 1.0) Overview of product and market competitors

A lot of companies provide a range of standalone UPS 700VA to 6kVA (generally for the commercial market) and rack mount UPS 700VA to 3kVA (server farms and industrial market), but very few provide both functions in one UPS range. Even fewer provide this combined technology upto 6kVA, most stop at 2 or 3kVA. The numbers of models within a range would then extend even further to include a different battery pack for each power module.

This is generally due to the markets they are in and the cost of developing a unified range upto 6kVA dual format. Manufacturers of UPS also concentrate their R&D on major computer OEM's (original equipment manufacturers) – which forces their product development to be more specific to that OEM's needs, not to the market as whole.

XPES are involved in all market area's including commercial IT, industrial, retail medical & Telecom which require racking as well as standalone. Developing a single range allows the users and resellers of this product to reduce inventory. Further reductions in inventory and therefore pricing is made by producing one unified range of battery packs suitable for all models.

There is a gap in the market for a fully featured On line UPS from 700 to 6kVA that combines the flexibility of a standalone & rack mount unified UPS range, at a cost that still means the product is competitive.

### 1.1) Uninterruptible Power Supply – Technology overview

An Uninterruptible Power Supply is designed to provide a battery based source of AC power, such that under mains fail conditions the load can be supported for a specified period of time.

This time is generally dictated by the period required to shutdown equipment in an orderly fashion, generator-starting time or for an engineer to attend site. In a high percentage of cases, utility failure is often less than 5 minutes – this is why most standard UPS's without external battery packs support the load for between 5 & 10 minutes.

This period is often only a "bridge" between mains fail and generator starting.

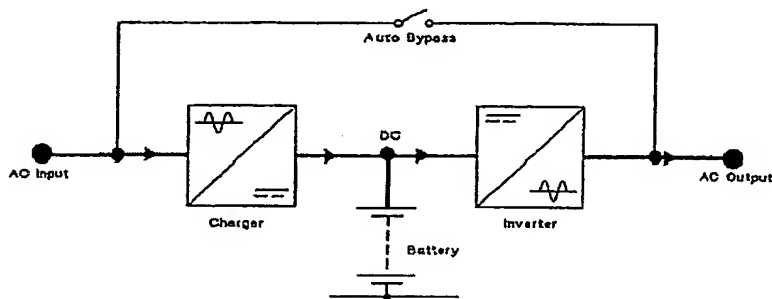


## 1.2) Uninterruptible Power Supply – Basic description of operation Page 2

There are three main types of UPS;

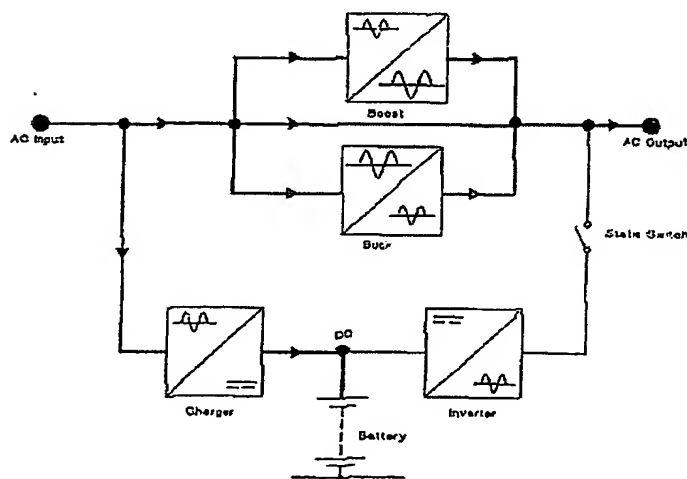
### On Line;

Under normal conditions mains is fed into the rectifier which provides both DC power to the Inverter and DC to charge the batteries. The inverter then feeds the load continuously. If mains fails, then the UPS continues to supply the load via the Inverter but the inverter is now fed its power from batteries not the rectifier. The load therefore sees no change. The static switch or auto bypass provides a fail-safe mechanism in UPS fault conditions of Inverter fail, rectifier fail & battery failure. This topology of UPS provides a true sinewave output under all circumstances and it provides in the order of 60-90dB's attenuation noise.



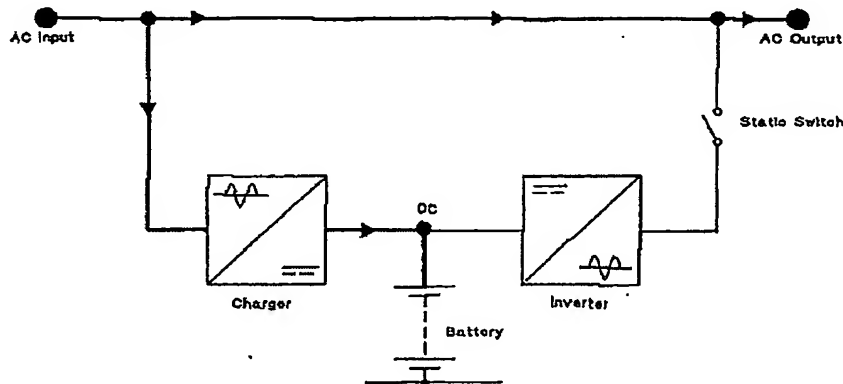
### Line Interactive;

During normal operation, mains power is supplied to the load via a buck/boost circuit in the UPS (the batteries are also float charged). Similar to the off line UPS there is a switch over time of 2 – 10mS between Inverter & Utility or visa versa. There is a small amount of line conditioning. (Input to output attenuation to noise is 20 – 30dB)





During normal operation mains is fed directly to the load & the batteries are float charged. When a power failure occurs there is a small switch time to Inverter (2 – 10mS). The load is then supported by battery via the inverter. The Inverter has a Quasi Sine wave output (which means it is a low cost Inverter). There is a very small amount of line conditioning (input to output attenuation to noise is 5dB)



### 1.3) Block descriptions

#### Charger/Rectifier

This module converts AC ("Utility"/"Mains") power to DC power. This DC then charges the battery and in the case of an On line UPS also provide DC power to the input of the Inverter.

#### Battery

The battery in any UPS system is the energy storage device. It provides DC power to the Inverter under mains fail conditions.

#### Inverter

This module converts DC from the battery to AC, which supplies the load. It can be Quasi sinewave (square wave output) for lower cost units like off line & line Interactive (low end models) and Sinewave for high end Line Interactive and On line models.

#### Static switch/Auto bypass

This is an intelligent switch that looks at both mains input and inverter output, switching automatically between them dependant on which source of power is available (Utility or Inverter). It also provides an overload route if an inverter in an On line UPS is asked to provide more power than it can deliver. The bypass protects the On line UPS against Inverter failure, Rectifier failure & battery failure.

The "Control" or "Power" module houses the charger, Bypass switch and Inverter. On smaller UPS below 2kVA the batteries are also housed within the same chassis.



## **2.0) Our Product specification key features;**

Single 48VDC battery voltage and battery pack for the entire range

Dual physical format in one model – standalone and rack mount

Modular slot together construction – no one component larger than single man lift

Standard Panel indent that allows for connection of modules when installed and for foot location on 2kVA model.

Dual position bezel LCD display – to enable standalone & rack mount format

Dual feed input – enables unit to be used as static switch/provides discrimination for feeds

Line up and match 1U/2U maintenance bypass for range





## 2.1) Single 48VDC battery voltage and battery pack for the entire range.

Most UPS's in the market today provide the ability to extend runtime by adding additional battery packs to the UPS. These battery packs normally are line up and match – that is to say they are in a similar format to the UPS's.

Everyone else in the market place provides one battery type per UPS model. So if there are five models in the range of UPS's, then there are generally five battery pack types that need to be used. Even when people rationalise these battery packs to work with a number of models, generally there are at least 3 battery pack formats for any product range from 700 to 6kVA.

The reason for this is to do with the efficiency of operation of UPS's as you increase the model numbers by power. The more power required the greater the current that has to be handled by the UPS. As current increases cable size has to increase or power will be wasted as heat in the conductors. So what happens is a compromise between current capability and heat dissipation as power increases. Ultimately this means that as power goes up so battery voltage is increased to keep the current-handling conductors to a manageable size.

The impact of this on battery packs is to increase the voltage of the pack as UPS power goes up. I.e. different battery packs are used for different power UPS's.

The battery packs for the new development utilise a different concept which allows the same battery packs to be connected to all models of UPS in the range 700 – 6kVA.

Each UPS within the range will require a certain voltage to operate as follows;

700-2000VA	Battery voltage will be 48VDC
2500-3000VA	Battery voltage will be 96VDC
4000-6000VA	Battery voltage will be 192VDC

But rather than produce three models of battery pack, we will provide only one.

This battery module will be 48VDC and each module will take up ½ of a 19" 2U frame – as shown below;



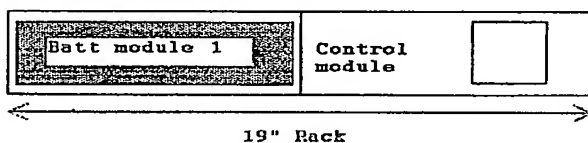
### 2.1.1) Battery connection

Since a battery pack is single 48VDC block, then we are reliant on the internal wiring within the UPS control module to configure these packs in Series or Parallel.

#### UPS model 700 – 2kVA

This unit will have only one 48VDC battery module mounted to the right of the control module (within one casing). All additional battery packs will be paralleled internally with this one.

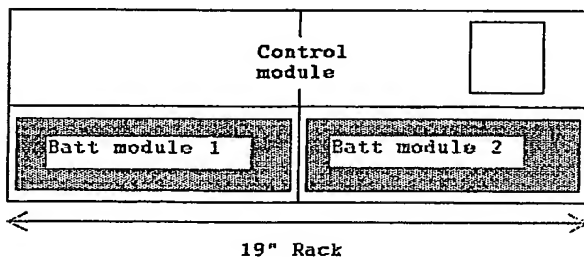
#### UPS model 3kVA



This unit will have only electronics in the control module. All the battery will be in the battery packs below. This will contain 2 x 48VDC battery module.

This will be configured at the rear of the UPS control module as series connection providing 96VDC.

All additional battery packs will be paralleled at 96VDC packs.



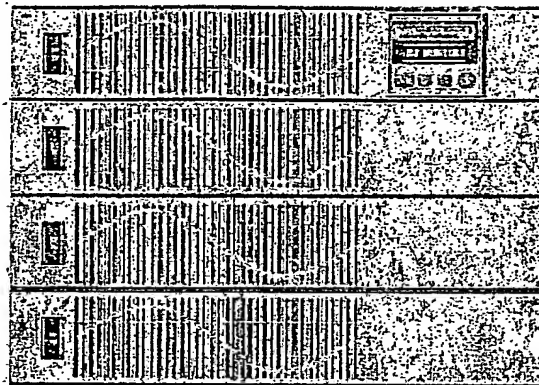
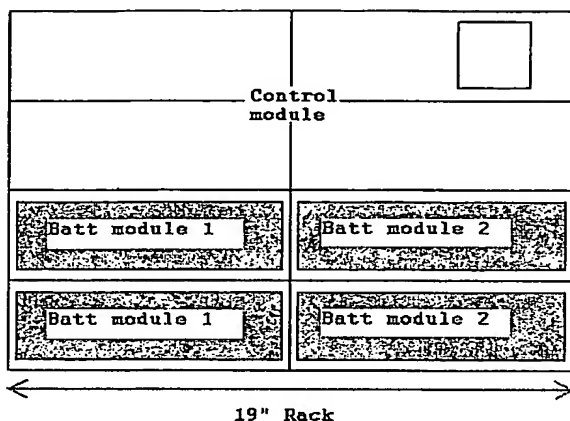


## UPS 4, 5 &amp; 6kVA models

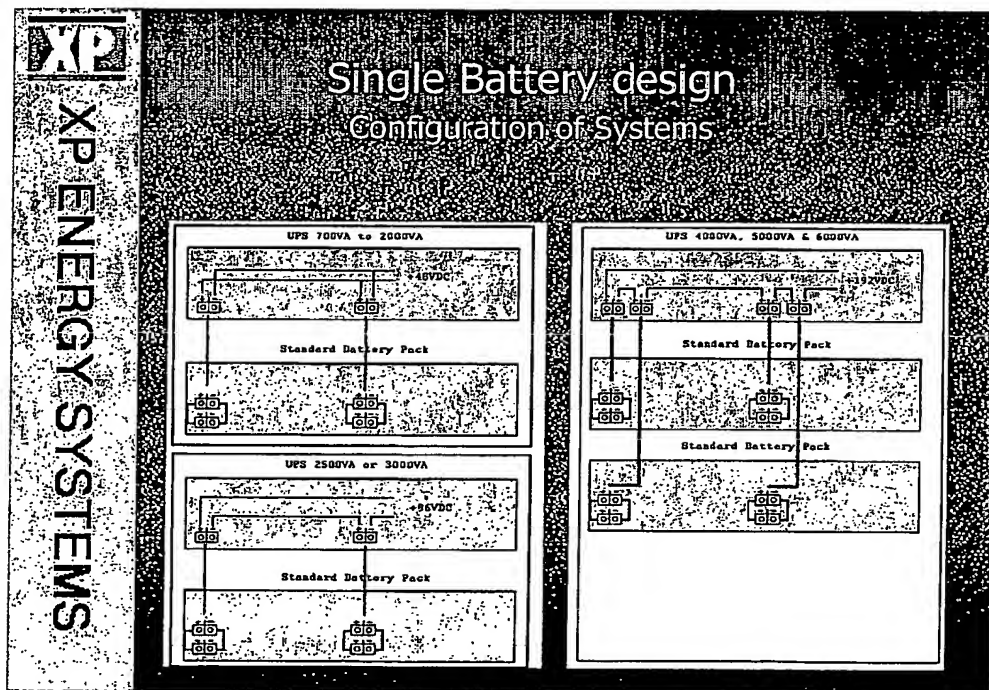
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2 battery packs (4 battery modules) need to be connected at this power to provide a series voltage of 192VDC.

Further packs are added in which are first put in series and then paralleled at the UPS.



## Internal battery configuration



This will mean that we can provide the following advantages to our customers;

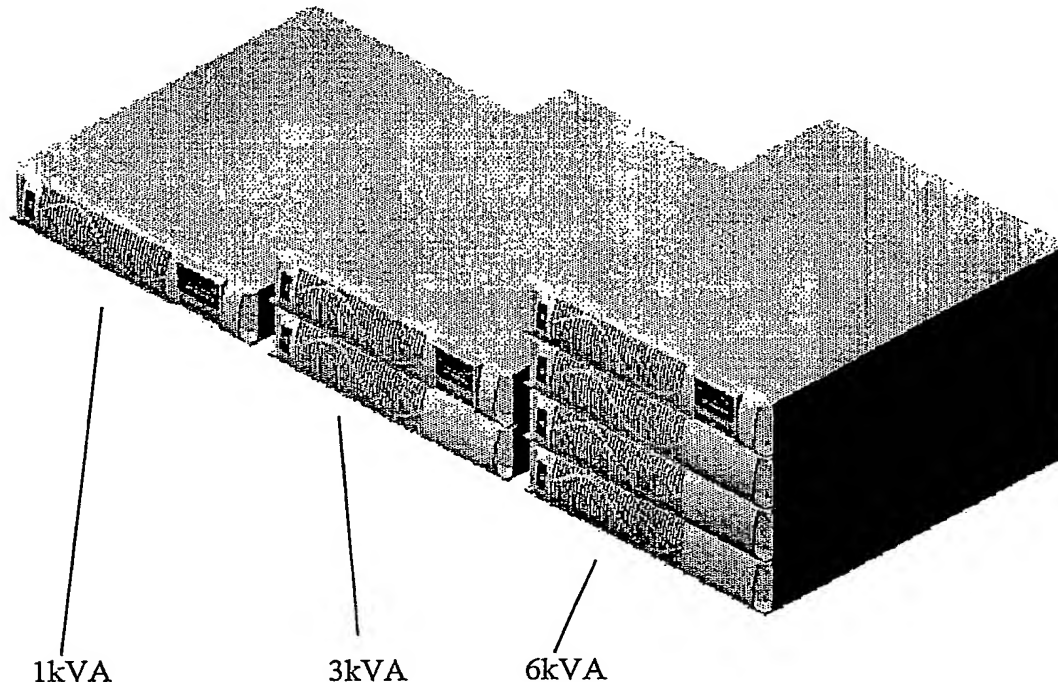
- Single component (battery pack) required – no confusion when fitting or re-ordering
- For stock agents or key accounts stock portfolio for battery packs reduced from 3-5 different models to one model. Stock cost greatly reduced. Stock availability to customer greatly increased
- High volume purchasing allows for lower cost price/resell price to users
- All battery packs are hot swap and interchangeable with each other

## 2.2) Dual Physical format Rack mount or standalone.

Very few models in the market today offer a dual format flexibility in a model range from 700 – 6kVA. The flexibility means that the unit can be either a free standing module or mounted in a 19" rack mount chassis.

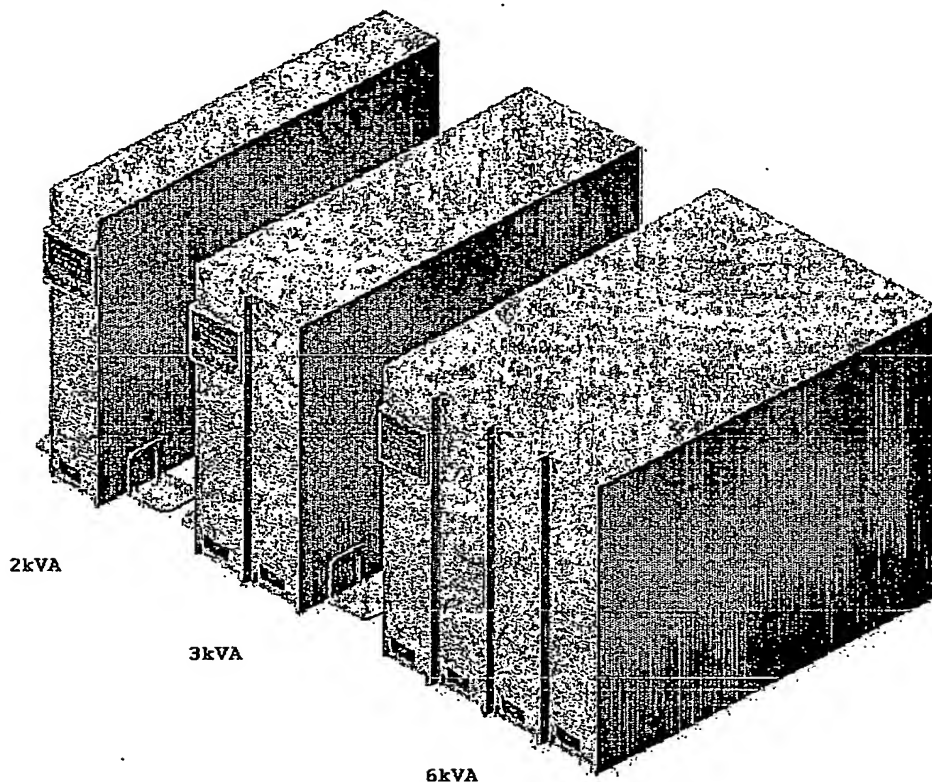
Given both formats are popular and used within the industrial and commercial sectors this again reduces stock needed and increases availability to our customers.

The format's flexibility is illustrated in the slide below; (rack mount configuration)



Standalone configuration;

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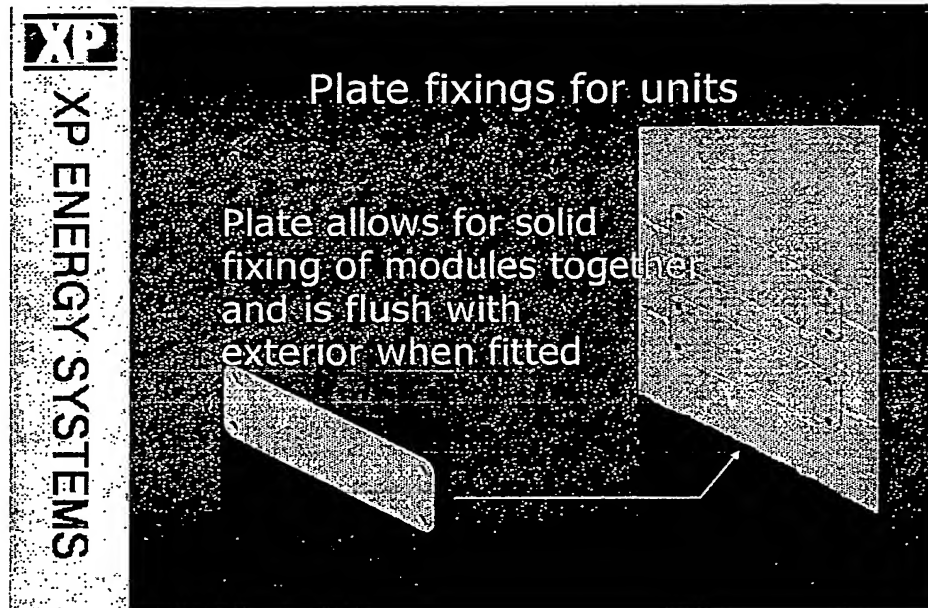
### 2.3) Modular slot together construction

The UPS product offering which is currently available on the market can mean some individual units at 5kVA and above can weigh in excess of 100kg's. Obviously manoeuvring and installing such a heavy UPS can have many issues – not the least is the problem that you will need two to three people to delivery of load and position the UPS because of the weight.

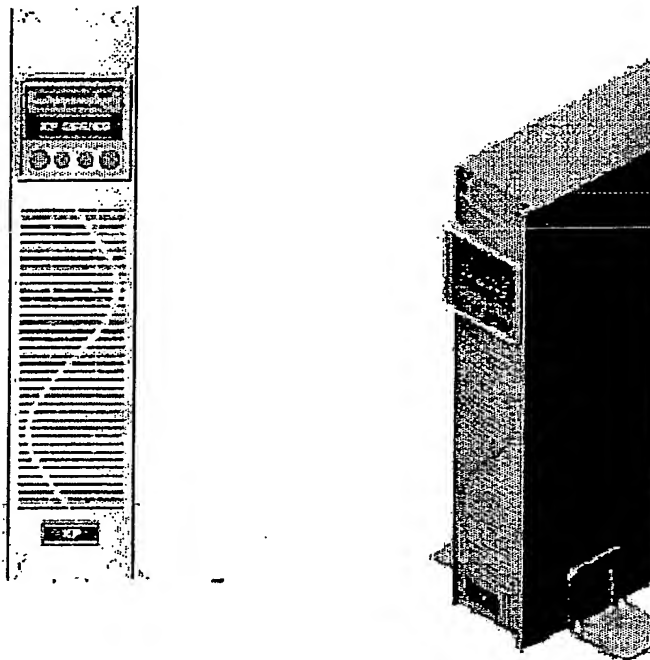
In general one man can lift a maximum of 25kg on his own. That means that if we can ensure that no one individual modular part (battery pack or Control module) of this UPS is greater than 25kg's, then we only need a single person to deliver off load and position the unit.



The new development product offers this as standard. When in situ, the UPS can be fixed to together in either rack mount or standalone format. As shown in the slide below;



The same indent on the units can be used to fix a foot onto for the smallest models within the series 700VA, 1000VA, 1500VA & 2000VA. This allows this model to be standalone. (see below)





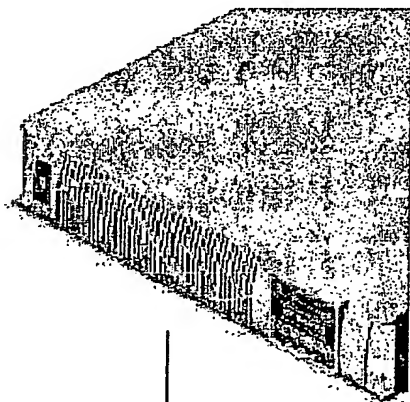
## 2.4) Dual Position Bezel

The main issue with having a dual physical format is how the customer can read information from the unit. If for example a LCD display is used, then when the unit is taken from standalone to rack mount – as the unit moves through 90 degrees – so does the display and it cannot be read.

Some manufacturers have got round this by making the display LED – this makes the unit easy to read in either orientation. The problems with LED displays is that a very small amount of information can be passed onto the user.

We have provided a bezel, housing a LCD display, which is adjustable between two positions. This means that in either standalone or rack mount that the information is available to the user. (see below)

This display also has a screensaver mode which will display the “XP” logo when it is not in use – thus allowing the branding of the unit to be in the right orientation for use.



19" rack mount (Horizontal)



Standalone (Vertical)

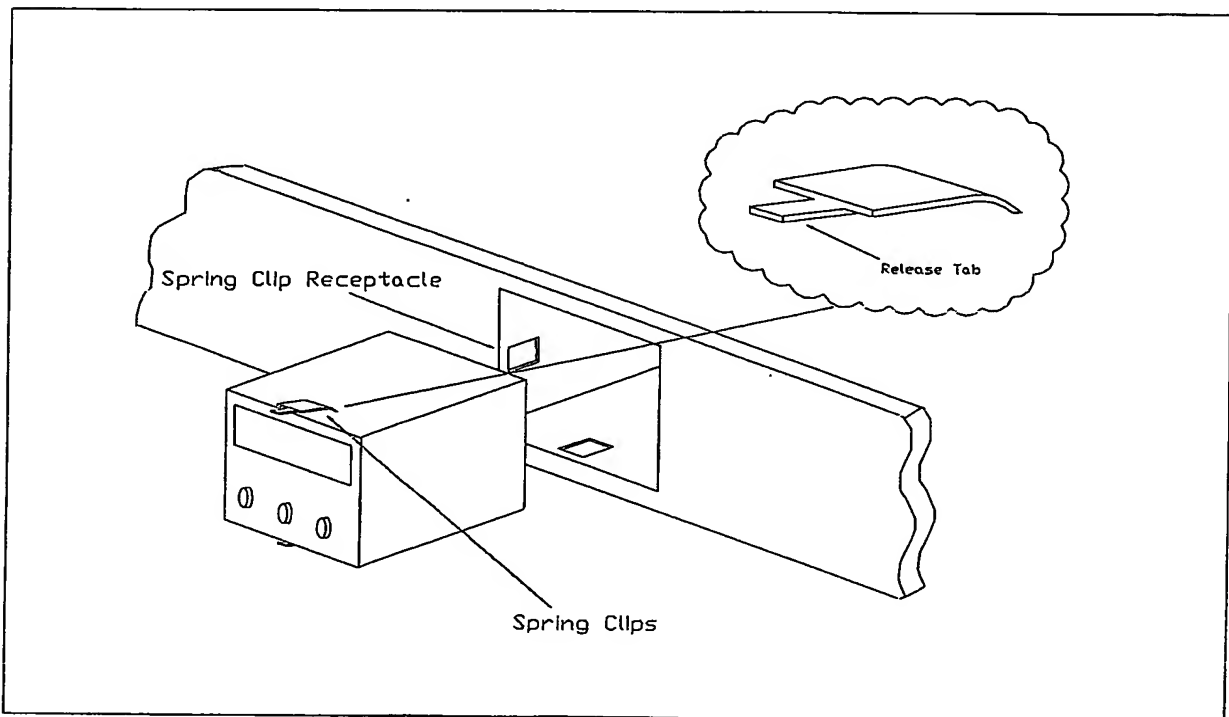
### 2.4.1) Dual Position Bezel detail

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The construction technique behind this feature is based around a separate LCD mount within the main chassis. That is to say that the LCD is in its own enclosure and connected to the UPS via ribbon cable on the rear of its enclosure.

The separate enclosure provides the user with the ability to configure the orientation of the panel without exposing in of the inner workings of the UPS.

The mount of the separate enclosure within the main subframe is critical. This mount is done using spring clips on each side fascia. This allows for the LCD panel to be



withdrawn and turned through about 90 degrees to allow for mounting in either a substantially vertical or a substantially horizontal plane (dependant on whether the unit is in it's rack mount or standalone format).



## 2.5) Dual Input feed

A feature common to all large UPS's is the ability to discriminate between two feeds.

This means in basic terms that the UPS can have two supplies and if any one of the supplies is broken, the UPS can continue to support critical loads without intervention. During normal operation of an On line UPS there is only one feed. If the rectifier has a problem it could take out its input breaker. If this breaker is open then the load WILL be dropped after battery has discharged. This is not a desirable circumstance. (see diagram 1 & 2)

This feature is unique in our smaller new development product to the market place, and provides an added level of confidence that the UPS will support the load in all circumstances.

Diagram 1

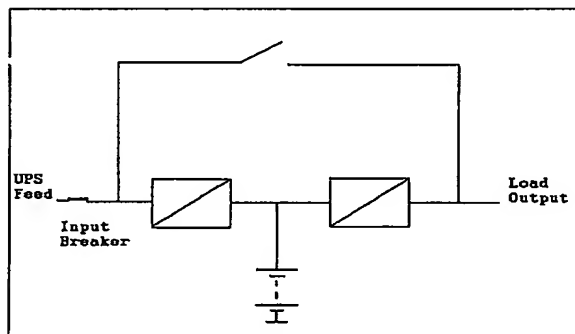
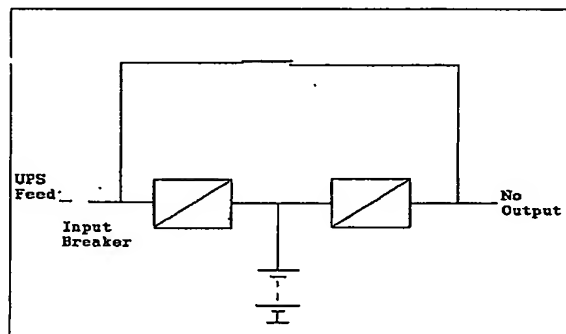


Diagram 2



The diagrams below shows how providing two separate inputs, means that even if we lose the UPS feed (via input breaker 1), then we can still support the load through the Bypass feed (via Input Breaker 2). This means that despite problems with the rectifier we do not expose the load!

Diagram 3

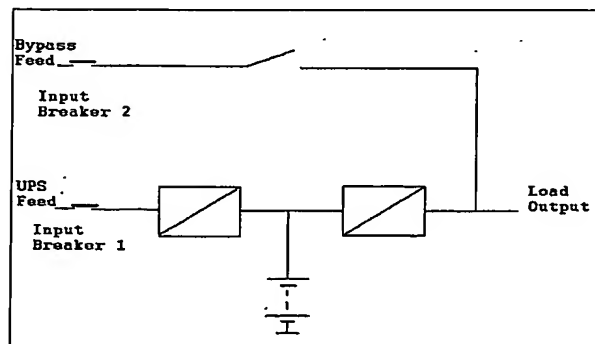
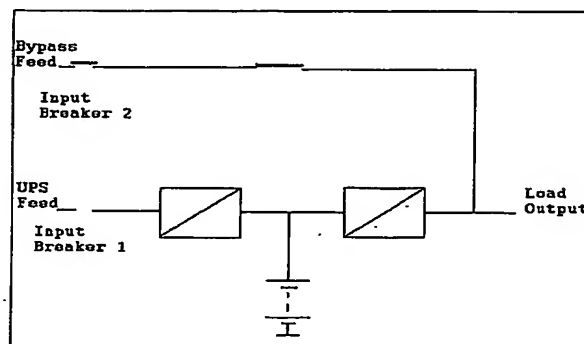


Diagram 4





## 2.6) Line up and match bypass

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The new design concept allows for a new type of line up and match maintenance bypass option. The maintenance bypass is used to isolate the UPS from the load during maintenance situations.

Because of the format we use for the units, we can utilise the indents to connect in either orientation a separate bypass box.

This bypass box would be 1U (44.45mm wide/high) for upto 2kVA and a maximum of 3U for upto 6kVA